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# CVN-21 Carrier Turbine Blade Tree Section

NCDMM Project No. 05-0060-07

## PROBLEM / OBJECTIVE

Dresser-Rand Corporation located in Wellsville, NY, is responsible for power generation for the new CVN-21 Carrier for the U.S. NAVY. Development of newer power generation systems has led to the use of advanced materials with characteristics that allow the turbine blade (bucket) to withstand increased condensation levels. The new material characteristics, with higher than normal Rockwell hardness, created many manufacturing challenges. Shorter tool life, longer processing times and longer hand finishing operations all contributed to extended lead times and additional cost. Having previously demonstrated that the use of state-of-the-market tooling along with advanced programming techniques can optimize tool performance, Dresser-Rand requested the help of the National Center for Defense Manufacturing and Machining (NCDMM) to review and provide solutions that would reduce the cost and part cycle times of this component.



Water jet cutting techniques being tested (left). Water jet cut parts at three different parameter sets (right).

## ACCOMPLISHMENTS / PAYOFF

### Process Improvement

After reviewing the current method, NCDMM engineers concluded that the roughing process encompassed the greatest optimization opportunity. The current method included drilling and milling with multiple tools. This process left uneven amounts of stock remaining on the part resulting in unpredictable tool life. NCDMM engineers determined water jet roughing would leave an even amount of stock while eliminating several roughing tools.

### Implementation and Technology Transfer

Realizing from past experience that the use of a dynamic machine would provide the desired solution, NCDMM contacted MetPlas Inc., located in Natrona Heights, PA. MetPlas specializes in water jet cutting with the 5-axis dynamic machine. MetPlas and NCDMM personnel performed test cuts on selected buckets. One bucket was selected and finished to size at the Dresser-Rand facility using their existing finishing process.

Following are the results of the advanced water jet roughing techniques that have been implemented or are in the process of being implemented:

- The tree form was rough-cut using the water jet process to allow even stock over the entire form.
- Dynamic water jet allowed taper control to less than 0.003 over 2-inch thick material.
- Several roughing tools were eliminated.
- Additional machine capacity

### Expected Benefits

With implementation of the water jet process significant savings can be seen. Based on an average of 2,000 buckets per year and an average machine shop rate of \$100/hour, this equates to a cost savings of \$76,000 in tooling alone with 1,550 hours of additional machine capacity per year for a total savings of \$1M over five years. It is also expected that the life of expensive form tooling will increase, resulting in additional cost savings yet to be determined.

MetPlas' supportive efforts have resulted in an order being placed with them. Once the order is complete, the true savings will be realized.

## TIME LINE / MILESTONE

Start Date.....July 05  
End Date.....September 05

## PROJECT FUNDING

NCDMM / Dresser-Rand (Cost Share)... ..<\$30K

## PARTICIPANTS

MetPlas Incorporated

For additional information concerning this project, contact the NCDMM at [www.ncdmm.org](http://www.ncdmm.org)